TRC

January 17, 2006

California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, California 90013

ATTN: MR. JIMMIE WOO

SITE: FORMER 76 STATION 0353
200 SOUTH CENTRAL AVENUE
GLENDALE, CALIFORNIA
LARWQCB FILE NO. 912040107

RE: HUMAN HEALTH RISK ASSESSMENT REPORT

Dear Mr. Woo:

On behalf of ConocoPhillips Company, TRC submits this human health risk assessment report for former 76 Station 0353, located at 200 South Central Avenue in Glendale, California. If you have any questions regarding this report or need additional information regarding this site, please call me at (949) 753-0101, or Ms. Shari London with ConocoPhillips Company at (714) 428-7720.

Sincerely,

TRC

John Nordenstam

John Nordenstam, RG
Senior Project Geologist

cc: Ms. Shari London, ConocoPhillips Company (electronic copy only)
Mr. Peter Hayden, Caruso Affiliated (electronic copy only)
Mr. Mark Berry, Department of Development Services, City of Glendale (electronic copy only)

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TRC

HUMAN HEALTH RISK ASSESSMENT REPORT

January 17, 2006

FORMER 76 STATION 0353
200 South Central Avenue
Glendale, California
LARWQCB File No. 912040107

TRC Project No. 20-0948

Prepared For:

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1.0 INTRODUCTION

This report summarizes the risk assessment activities conducted for former 76 Station 0353, located at 200 South Central Avenue in Glendale, California (see Figure 1). In order to evaluate if hydrocarbon-affected soil present beneath the site poses a potential risk to humans associated with the proposed development of the subject site, available data were evaluated, a receptor/pathway exposure assessment was completed, available toxicity data were reviewed, and the potential risk to humans was estimated.

This scope of work was conducted in accordance with the TRC Remedial Action Plan dated July 11, 2005, and the TRC Notice of Intent Letter dated August 31, 2005. The licensed professional in responsible charge supervised all work associated with the project within the purview of the professional as defined in the Geologist and Geophysicists Act of the California Code of Regulations.

2.0 BACKGROUND

2.1 SITE DESCRIPTION

Present Site Use: The site is an inactive service station located on the southeast corner of South Central Avenue and West Harvard Street. The site is currently a fenced, vacant lot. All former service station facilities have been removed from the site (see Figure 2).

Future Site Use: The City of Glendale acquired the property from ConocoPhillips through condemnation proceedings. The City of Glendale Redevelopment Agency is planning on redeveloping the site with a mix of retail and residential uses and associated underground parking areas.

Adjacent Properties: The Glendale Galleria Shopping Center is located west of the site. The properties north, east and south of the site are part of the planned redevelopment and are currently vacant.

Geography: The site is located within the southeastern portion of the San Fernando Valley between the eastern end of the Santa Monica Mountains (approximately 1 mile to the west of the site) and the Verdugo Mountains (approximately 1.5 miles east of the site). Interstate 5 and the Los Angeles River (in a concrete lined channel) are located approximately 1 mile west of the site. Verdugo Wash is located approximately 1 mile north of the site. The site is located at an elevation of approximately 517 feet above mean sea level (NGVD-1929). The topography in the area slopes gently to the southwest (United States Geological Survey, 1966).

Regional Geology/ Hydrogeology:

The site is located within the Upper Los Angeles River Area (ULARA). The ULARA encompasses all the watershed of the Los Angeles River and its tributaries above a point in the river designated as Los Angeles County Department of Public Works (LACDPW) Gauging Station F-57C-R, near the junction of the Los Angeles River and the Arroyo Seco. The ULARA is bounded on the north and northwest by the Santa Susana Mountains; on the north and northeast by the San Gabriel Mountains; on the east by the San Rafael Hills, which separate it from the San Gabriel Basin; on the south by the Santa Monica Mountains, which separate it from the Los Angeles Coastal Plain; and on the west by the Simi Hills (ULARA Watermaster, 2003).

The ULARA has four distinct groundwater basins. The water supplies of these basins are separate and are replenished by deep percolation from rainfall, surface runoff and from a portion of the water that is delivered for use within these basins. The four groundwater basins in the ULARA are the San Fernando, Sylmar, Verdugo, and Eagle Rock Basins (ULARA Watermaster, 2003).

The site is located within the southeastern portion of the San Fernando Basin. The San Fernando Basin is the largest of the four groundwater basins within the ULARA. It is bounded on the east and northeast by the San Rafael Hills, Verdugo Mountains, and the San Gabriel Mountains; on the north by the San Gabriel Mountains and the eroded south limb of the Little Tujunga Syncline which separates it from the Sylmar Basin; on the northwest and west by the Santa Susana Mountains and the Simi Hills; and on the south by the Santa Monica Mountains (ULARA Watermaster, 2003).

Regional groundwater in the area of the site occurs in Quaternary alluvial deposits consisting primarily of sand and gravels with localized, interbedded lenses of silt and clay. The alluvium overlies sandstone and conglomerates of the Topanga Formation (Department of Water and Power, 1983). The regional groundwater flow in the area of the site is directed toward the southwest (ULARA Watermaster, 2003).

The site is located within the Crystal Springs Well Field. The Crystal Springs Well Field is on the Federal National Priority List (NPL) as a Federal Superfund site due to the presence of chlorinated hydrocarbons in the groundwater (City of Glendale-Water Section, 1993). Although the site is located within the Crystal Springs Well Field NPL Superfund site, the actual chlorinated solvent plume in Glendale is limited to areas along San Fernando Road and west of San Fernando Road, approximately 3,500 feet west of the site (ULARA Watermaster, 2003). A groundwater extraction and treatment facility was constructed in October 1999 to remediate contaminated groundwater within the Crystal Springs Well Field (City of Glendale-Water Section, 1993).

2.2 PREVIOUS INVESTIGATIONS

In July 1994, two 10,000-gallon gasoline underground storage tanks (USTs) and one 550-gallon waste oil UST were excavated and removed from the site. Eight soil samples (BT-1 through BT-8) were collected from the gasoline UST excavation at approximately 16 feet below grade (fbg). Two soil samples (BT-9 and BT-10) were collected from the waste oil UST excavation at approximately 9 fbg. Six soil samples (DI-1 through DI-6) were collected from beneath the former dispensers at approximately 3 fbg. Two soil samples (PL-1 and PL-2) were collected from beneath the former product lines at approximately 3 fbg (Emcon, 1996).

Concentrations of total petroleum hydrocarbons as gasoline (TPH-G) of 998 and 1,295 milligrams per kilogram (mg/kg) were detected in Soil Samples BT-4 and BT-8, respectively, collected from the eastern portion of the gasoline UST excavation. No detectable concentrations of TPH-G; total recoverable petroleum hydrocarbons (TRPH); benzene, toluene, ethylbenzene, or total xylenes (BTEX) were present in Soil Samples BT-9 and BT-10 collected from the waste oil UST excavation. A TPH-G concentration of 4,562 mg/kg was detected in Soil Sample DI-6 collected from the eastern portion of the eastern dispenser island. No detectable concentrations of TPH-G or BTEX were present in Soil Sample PL-1 collected from the beneath the product lines. Concentrations of 0.009 and 0.011 mg/kg of toluene and total xylenes, respectively, were detected in Soil Sample PL-2; no detectable concentrations of TPH-G, benzene, or ethylbenzene were present in this sample (Emcon, 1996).

Based on the results of laboratory analysis of soil samples collected during UST removal activities, the eastern portion of the eastern dispenser island and the eastern portion of the gasoline UST excavation were over excavated to depths of approximately 7 and 20 fbg, respectively. Two soil samples (BT-4A and BT-8A) were collected from the gasoline UST over excavation and one soil sample (DI-6A) was collected from the dispenser island over excavation. No detectable concentration of TPH-G was present in Soil Sample BT-4A. Detectable TPH-G concentrations of 683 and 3,458 mg/kg were present in Soil Samples BT-8A and DI-6A, respectively (Emcon, 1996).

Following soil sampling and over excavation activities, two 20,000-gallon gasoline USTs were installed in the same area as the former gasoline USTs (oriented north-south vs. east-west orientation of former gasoline USTs) and a 550-gallon waste oil UST was installed at the same location as the former waste oil UST (Emcon, 1996).

In March 1995, six borings (E-1 through E-6 and E-1A) were drilled in the vicinity of the gasoline USTs and the eastern dispenser island (see Figure 2). Boring E-1 was drilled through a conductor casing installed in the eastern portion of the gasoline UST excavation. Boring E-1 was only drilled to a total depth of approximately 25 fbg due to auger refusal. Borings E-1A, E-1, and E-2 were converted to vapor extraction wells. Groundwater was not encountered during this investigation (maximum depth of investigation approximately 73.5 fbg). A maximum TPH-G concentration of 2,800 mg/kg was detected in the soil sample collected from Boring E-1 at approximately 25 fbg. A maximum TPH-G concentration of 940 mg/kg was detected in the soil sample collected from Boring E-1A at approximately 51 fbg. Concentrations of TPH-G ranging from non-detect to less than 2 mg/kg were detected in soil samples collected from Borings E-2 through E-5 (Emcon, 1996).

In April 1995, a vapor extraction test was conducted at the site using Vapor Wells E-1A, E-1, and E-2. Flow rates ranging from approximately 19.8 to 39.5 standard cubic feet per minute (scfm) and vacuum ranging from approximately 2.1 to 13 inches of water were observed during testing activities. Concentrations of TPH-G ranging from 2,700 to 19,000 parts per million by volume (ppmv) were detected in vapor samples collected from Wells E-1, E-1A, and E-2. Based on the results of the testing activities, the estimated radius of influence (ERI) ranged from approximately 28 to 32 feet (Emcon, 1996).

In May 1998, the City of Glendale Fire Department issued site closure based on the designation of the property as a "low risk" site.

In February 2004, at the request of the Glendale Redevelopment Agency, six borings (B1 through B6) and 48 direct-push borings (GP-1 through GP-48) were drilled and sampled at the site (see Figure 2). Groundwater was encountered at approximately 105 fbg during soil sampling activities. Maximum TPH-G and benzene concentrations of 24,300 and 75.3 mg/kg, respectively, were detected in the soil sample collected from Boring B1 at approximately 55 fbg. A maximum methyl tertiary butyl ether (MTBE) concentration of 0.646 mg/kg was detected in the soil sample collected from Boring B4 at approximately 55 fbg. A maximum tertiary butyl alcohol (TBA) concentration of 0.181 mg/kg was detected in the soil sample collected from Boring B3 at approximately 55 fbg. In addition, four shallow (less than 10 feet deep) and two deeper (up to approximately 15 feet deep), diesel/heavy-end hydrocarbon soil plumes were detected in the southern portion of the site (EP Associates, 2004a).

In August 2004, Monitoring Wells MW-1 through MW-5 were drilled and installed at the site (see Figure 2). Groundwater was encountered at approximately 100 fbg during well installation activities. A maximum TPH-G concentration of 2,200 mg/kg was detected in the soil sample collected from Monitoring Well MW-3 at approximately 75 fbg. Maximum MTBE and TBA concentrations of 0.391 and 0.610 mg/kg, respectively, were detected in the soil sample collected from Monitoring Well MW-1 at approximately 55 fbg (EP Associates, 2004b).

A quarterly fluid level monitoring and groundwater sampling program was initiated in September 2004 and continues to date (TRC, 2005b).

In December 2004, Monitoring Wells MW-6 through MW-9 were drilled and installed at the site (see Figure 2). Groundwater was encountered at approximately 102.5 to 105 fbg during well installation activities. One soil sample was collected from each monitoring well at approximately 105 fbg. No detectable concentrations of TPH-G, TPH as diesel (TPH-D), BTEX, MTBE, di-isopropyl ether (DIPE), ethyl tertiary butyl ether (ETBE), tertiary amyl methyl ether (TAME), TBA, or volatile organic compounds (VOCs) were present in the soil samples collected from Monitoring Wells MW-6 through MW-9 at approximately 105 fbg (EP Associates, 2005).

In July 2005, in order to facilitate removal of the gasoline USTs, onsite Monitoring Wells MW-1 and MW-3 were properly abandoned (TRC, 2005a).

In July 2005, site demolition activities were conducted. Two 20,000-gallon gasoline USTs, one 550-gallon waste oil UST, associated product lines and dispensers were excavated and removed from the site. Eight soil samples (TC-1 through TC-8) were collected from the gasoline UST excavation at approximately 17 fbg. Two soil samples (WO-1 and WO-2) were collected from the waste oil UST excavation at approximately 7 and 9 fbg. Five soil samples (D-1 through D-5) were collected from beneath the dispensers at depths ranging from approximately 3 to 4 fbg. Six soil samples (PL-1 through PL-6) were collected from beneath the product lines at depths ranging from approximately 2.5 to 4 fbg. Three soil samples (VL-1, VL-2, and VL-3) were collected from beneath the vent lines at depths of 3.5 and 4 fbg. Two soil samples (H-1 and H-2) were collected from beneath the hydraulic hoists at depths of approximately 8.5 and 9 fbg, and two soil samples (C-1 and C-2) were collected from beneath the clarifier at approximately 5.5 fbg. No detectable concentrations of TPH-G, BTEX, MTBE, DIPE, ETBE, TAME, TBA or ethanol were present in soil samples collected from beneath the former: gasoline USTs (TC-1 through TC-8), dispensers (D-1 through D-5), product lines (PL-1 through PL-6), or vent lines (VL-1 through VL-3). No detectable concentrations of TRPH, TPH-G, BTEX, MTBE, DIPE, ETBE, TAME, TBA or ethanol were present in soil samples collected from beneath the former hydraulic hoists (H-1 and H-2) or clarifier (C-1 and C-2). TRPH concentrations of 55 and 790 mg/kg were present in Soil Samples WO-1 and WO-2, respectively, collected from beneath the former waste oil UST. Total lead concentrations were detected in Soil Samples TC-1 (8.3 mg/kg), TC-2 (6.2 mg/kg), WO-1 (3.4 mg/kg), and WO-2 (13 mg/kg) (TRC, 2005c).

In August 2005, Monitoring Wells MW-1A and MW-3A, and Vapor Wells VW-1A, VW-1B/C, VW-2A, VW-2B/C, VW-3A, and VW-3B/C were installed in the vicinity of the former gasoline USTs (see Figure 2). A maximum total purgeable petroleum hydrocarbon (TPPH) concentration of 390 mg/kg was detected in the soil sample collected from Monitoring Well MW-1A at approximately 51 fbg. A maximum benzene concentration of 0.033 mg/kg was detected in the soil sample collected from Vapor Well VW-3B/C at approximately 65.5 fbg. A maximum MTBE concentration of 0.63 mg/kg was detected in the soil sample collected from Vapor Well VW-3B/C at approximately 91.5 fbg (TRC, 2005d)

In August 2005, a total of eight soil gas probes were installed at the site (see Figure 2). Two clusters of 3 soil gas probes each (SG-1 and SG-2) were installed in the gasoline UST area and two single soil gas probes (SG-3 and SG-4) were installed in the southern portion of the site. The soil gas probe clusters (SG-1 and SG-2) consisted of 3 soil gas probes installed at depths of approximately 15, 20, and 25 fbg. Soil Gas Probes SG-3 and SG-4 were installed to total depths of approximately 15 fbg. A maximum TPH-G concentration of 2.3 ppmv was detected in the soil vapor sample collected from Soil Gas Probe SG-1 at approximately 20.0 fbg. A maximum benzene concentration of 0.0021 ppmv was detected in the soil vapor sample collected from Soil Gas Probe SG-4 at approximately 15.0 fbg. A maximum MTBE concentration 0.0064 ppmv was detected in the soil vapor sample collected from Soil Gas Probe SG-2 at approximately 20.0 fbg (TRC, 2005d).

Based on the results of quarterly fluid level monitoring and groundwater sampling activities conducted in July 2005:

- Groundwater is present at depths ranging from approximately 99 to 101 fbg. The groundwater gradient is approximately 0.01 foot per foot directed toward the west (TRC, 2005b).

- No detectable concentrations of total purgeable petroleum hydrocarbons (TPPH) or BTEX were present in the groundwater samples collected from Monitoring Wells MW-1 through MW-9 (TRC, 2005b).

- A MTBE concentration of 2.6 micrograms per liter (ug/l) was detected in the groundwater sample collected from Monitoring Well MW-3. J-Flag concentrations [between the Method Detection Limit (MDL) and Practical Quantitation Limit(PQL)] of MTBE were present in groundwater samples collected from Monitoring Wells MW-4 (0.20 ug/l), MW-5 (0.23 ug/l), MW-6 (1.2 ug/l) and MW-8 (0.20 ug/l) (TRC, 2005b).

- No detectable concentrations of TAME, DIPE, ETBE, TBA, or ethanol were present in groundwater samples collected from Monitoring Wells MW-1 through MW-9 (TRC, 2005b).

3.0 HUMAN HEALTH RISK ASSESSMENT

To evaluate if contaminated soil poses a potential risk to humans associated with the proposed development of the subject site, available data were evaluated, a receptor/pathway exposure assessment was completed, available toxicity data were reviewed, and the potential risk to humans was estimated. For this evaluation, chemicals that were included in the quantitative risk evaluation include BTEX and MTBE. These constituents generally represent the primary constituents of interest for health risk assessments involving gasoline-range hydrocarbons. The equations and input parameters used for risk simulations have been summarized and are included in Appendix A.

3.1 EXPOSURE ASSESSMENT

An exposure assessment is the process of estimating potential human exposure to a chemical in the environment. An exposure assessment is conducted to estimate the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed. In a typical exposure assessment, reasonable maximum estimates of exposure are developed for both current and future land-use assumptions (EPA, 1989). The subject property currently exists as a vacant lot, but future development for commercial and/or residential applications, including the construction of an underground parking area, is anticipated. Consequently, a reasonable maximum estimate of exposure was developed for these anticipated future uses of the subject property.

Off-site potential receptors/pathways other than those directly associated with the future site development were not considered in this risk assessment. Risks that are protective of onsite exposures would also be protective of offsite exposures.

The primary components of an exposure assessment include:

- Identification of the potential exposure pathway(s).
- Identification of reasonable exposure scenarios.
- Prediction of chemical concentrations at points of potential exposure.

Exposure pathways are identified based on consideration of the sources, releases, types, and locations of chemicals at the site; the environmental fate of chemicals, and the location and activities of potentially exposed populations (EPA, 1989). For a complete exposure pathway to exist, the following elements must be present:

- A source or mechanism for chemical release.
- An environmental transport medium.
- A point of human exposure with the medium.
- A route of exposure.

An incomplete exposure pathway is one that does not result in potential human exposure and, therefore, does not result in a significant risk. If a complete exposure pathway is identified, potential exposures may be quantified and risk evaluation performed or the exposure pathway may be eliminated through remedial measures or other engineering and administrative controls.

According to EPA (1989), exposure pathways may be excluded from quantitative evaluation based on the following conditions:

- The exposure resulting from the pathway is much less than that from another pathway involving the same medium at the same exposure point.
- The potential magnitude of exposure from a pathway is low.
- The probability of exposure occurring is very low and the risks associated with the occurrence are not high.

Estimates of exposure in this assessment are based on data collected during a soil gas survey conducted in August 2005. A summary of the results of laboratory analysis of soil vapor samples is provided in Table 1.

3.1.1 Exposure Pathways and Scenarios

Typical exposure pathways as specified by the EPA have been considered (EPA, 1991a and 1991b). This evaluation identifies the potential receptors and exposure pathways through which humans (i.e., receptors) can potentially be exposed to chemicals. Potential exposure pathways were evaluated to reflect the actual site conditions and anticipated future land use without being unrealistically conservative. The uncertainties associated with assumptions regarding specific property development activities and planned land use are not considered to have a substantive effect on the exposure pathway analysis unless such activities or land use are dramatically different from that assumed for this analysis. An example of a dramatically different land use would include, for example, construction of a school or daycare center on the subject property. Given the current site zoning and surrounding land use, it does not appear that these alternate land use scenarios are likely.

Pathways that do not exist, are not relevant to the subject property development plans, or have a low potential of exposure were excluded from further consideration and were not evaluated quantitatively. For example, impacted soils exist below the ground surface and exposure pathways that require direct contact with impacted soil (i.e., dermal contact and incidental ingestion of soil) are not anticipated to occur. Consequently, the direct exposure pathway is incomplete and is not evaluated quantitatively. The vast majority of the site will either be paved or covered with structures or other improvements under a post-development scenario. If future direct contact with impacted soil were to occur, it is anticipated that the frequency and magnitude of the exposure would be low.

A quantitative evaluation of potential human exposure and risk was completed for the vapor diffusion pathway. This exposure scenario involves inhalation of volatile compounds from subsurface soil by future employees and/or visitors in indoor air. In addition, potential exposures were evaluated for hypothetical residential use of the subject property.

The majority of the site footprint will be encompassed by a subterranean parking structure. Given the presence of the subterranean parking structure, it is considered unlikely that the volatile organic compounds would diffuse into structures that overlie the subterranean parking area. Given the difficulty associated with modeling subsequent movement of vapors from the parking structure to indoor air of continuously occupied structures, exposure point concentrations of VOCs in air were based on the estimated concentrations of VOCs in air within the underground parking structure. This conservative estimate of the exposure point concentration is higher than the concentration that would exist within a continuously occupied portion of the development. It should be noted that this assumption results in an evaluation that is both conservative and unlikely to occur under future site conditions.

In order to account for ventilation within the subterranean parking area, the minimum required ventilation rate for a parking garage was derived from the Uniform Building Code (UBC) Chapter 12. Once the VOCs have migrated from the subsurface and into the parking area, the air exchange associated with the ventilation represents the primary loss mechanism for the VOCs.

The potential human exposures were evaluated for hypothetical future subject property employees based on a reasonable maximum exposure (RME) scenario. The RME scenario represents an estimate of the reasonable maximum exposure that expected to occur under current and future land uses. In general, the RME is defined as the highest exposure that is reasonably expected to occur at a site. The intent of the RME is to estimate a conservative exposure condition (i.e., well above the average exposure) that is still within the range of possible exposures.

3.1.2 Potential Future Onsite Residential and/or Worker Exposures

Post development use of the subject property may include commercial, residential, or mixed-use alternatives. Given the uncertainty regarding the actual future use of the subject property, potential exposures and risks were evaluated for both the commercial and residential land use scenarios. For the purpose of quantitatively evaluating potential exposures and risks, TRC assumed that the subject property would be constructed with a single story structure consisting of an underground parking structure extending to a depth of approximately 15 feet below grade. Under the post development exposure scenario, the dermal and incidental ingestion of soil exposure pathways are incomplete (due to the anticipated presence of paving and buildings across the majority of the subject site) and are not quantitatively evaluated. The following approach was used to estimate exposure point concentrations of chemicals of potential concern and human health risks resulting from the exposure:

- The route of exposure is inhalation of vapors from soil.
- The analytical results of soil gas samples collected on August 22, 2005 were used as the basis for performing a vapor diffusion analysis. The highest concentrations of BTEX and MTBE detected during the soil gas sampling were used to predict upper-bound concentrations of these constituents in indoor air under the post-development scenario.
- A hypothetical building footprint of approximately 10 meters by 10 meters with a ceiling height of 2.44 meters was assumed for the indoor air diffusion analysis. It should be noted that the assumed height reflects that of one level of the underground parking structure.
- A ventilation rate of 1.5 cubic feet per square foot for the underground parking structure was utilized based on the UBC Chapter 12. For the given footprint the indoor air exchange for the underground parking structure occurs once every ten minutes, or six times per hour.
- Diffusion from the source zone into indoor air was modeled based on the Johnson and Ettinger diffusion model (Johnson and Ettinger, 1991). The California Office of Environmental Health Hazard Assessment (OEHHA) cancer slope factors for benzene and MTBE were used in place of USEPA values.
- Default values of soil porosity and permeability for "sand" were specified in the Johnson and Ettinger diffusion model. Previous environmental assessment activities indicate that the subsurface soil consists primarily of sand to depths of at least 120 fbg.
- Soil properties in any horizontal plane were considered to be homogeneous and the contaminants were assumed to be homogeneously distributed within the subsurface.
- The mass of contaminants present in the subsurface was conservatively assumed to be unlimited (i.e., non-diminishing). This assumption would result in overestimating the exposure point concentrations of chemicals in indoor air.
- Except for selected site specific parameters (e.g. soil properties) and ventilation rate within the parking structure, default input parameters from EPA guidance documents were used (Johnson and Ettinger, 1991).
- The exposure parameters for the commercial onsite worker reflect an exposure duration of 10 hours per day and 250 days per year over a period of twenty-five years. The exposure duration for the future residential exposure scenario is 24 hours per day, 350 days per year over a period of thirty years.

3.2 RISK ASSESSMENT RESULTS

Risk characterization yields upper-bound estimates of carcinogenic and non-carcinogenic health risks by combining the quantitative exposure and dose-response estimates. In the risk assessment of human exposures to carcinogenic chemicals under this evaluation, the *de minimis* or insignificant risk level of 1 in 1,000,000 (1×10^{-6}) was used. This *de minimis* risk is within the range of acceptable risk levels that have historically been applied in risk management decision-making. In general, de minimis risks in federal regulatory decision-making range from 1 in 10,000 (1×10^{-4}) to 1 in 1,000,000 (1×10^{-6}). In general, acceptable risks of 1×10^{-6} have been used where large populations may be exposed. Higher risks (e.g., 1×10^{-4}) have been considered to be acceptable when relatively small populations may be exposed.

For non-carcinogenic effects, a Hazard Index approach is used to evaluate potential risks. The hazard index approach assumes that non-carcinogenic effects occur when a threshold level of exposure is exceeded. Therefore, a hazard index of 1.0 or less indicates that no adverse non-carcinogenic health risks are expected to occur.

Carcinogenic risks were estimated using the EPA SG-ADV program equations as presented in Appendix A. The methodology and results of the vapor diffusion analysis for benzene are summarized in Appendix A, Table A-1 to A-6.

3.2.1 Future Onsite Worker Exposure

The cumulative lifetime incremental cancer risk estimate for the future onsite worker scenarios is 5×10^{-9}. This value is approximately 200 times below than the 1×10^{-6} criteria for acceptable lifetime risk. The cumulative, non-carcinogenic hazard index is estimated as 0.0002. The hazard index is approximately 5,000 times below the acceptable hazard index of 1.0. Based on this RME scenario, the potential risks to future employees working inside of a proposed onsite structure are below acceptable risk levels as established by EPA, CalEPA, and other regulatory entities. Consequently, no additional remediation, mitigation or engineering controls would be required to reduce potential risks to less than 1×10^{-6}.

3.2.2 Future Residential Occupant Exposure

The cumulative lifetime incremental cancer risk estimate for the future residential occupant scenarios is 1×10^{-8}. This value is approximately 100 times below the 1×10^{-6} criteria for acceptable lifetime risk. The cumulative, non-carcinogenic hazard index is estimated as 0.0003. The hazard index is approximately 1,000 times below the acceptable hazard index of 1.0. Based on this RME scenario, the potential risks to future residential occupants inside of a proposed onsite structure are below acceptable risk levels as established by EPA, CalEPA, and other regulatory entities. Consequently, no additional remediation, mitigation or engineering controls would be required to reduce potential risks to less than 1×10^{-6}.

3.3 UNCERTAINTIES AND LIMITATIONS

There is a degree of uncertainty in any simulation of natural processes. To account for these uncertainties, the vapor diffusion model used in this risk assessment was designed to be conservative or to "err on the safe side". The vapor diffusion model used in this risk assessment does not take into consideration legitimate natural processes such as biodegradation and source reduction. In this respect, the model does not approximate conditions that are likely to exist.

Therefore, this model and subsequent risk values are judged to be conservative and may actually be much lower than estimated in this analysis. The reader is encouraged to consider this assumption in light of the calculated human health risks.

Where values are uncertain because of a lack of site-specific data, regulatory agency default values and/or conservative values have been used. Matrix-specific chemical concentrations were derived from soil gas samples collected below the proposed building footprint.

3.3.1 Biased Data

3.3.1.1 Potential for Spatially Biased Data

The collection of information to characterize the nature and extent of contamination at a site is commonly not designed to provide representative, unbiased data sets for exposure estimates. This is typical for site assessment data when data are not collected in a simple random and/or systematic random manner. However, the highest detected soil vapor concentration for any of the chemicals of potential concern detected during vapor sampling was used to conservatively estimate indoor air concentrations of these constituents over the exposure duration.

3.3.1.2 Potential for Temporally Biased Data

The cumulative data set includes samples collected in August 2005. Degradation of petroleum hydrocarbons by anaerobic and aerobic pathways is a recognized and well-documented natural process. This risk assessment did not consider the potential for biodegradation to result in decreased soil gas concentrations over time. Further, the risk assessment did not consider potential depletion of the source due to volatilization and natural attenuation. By ignoring these factors, the risk assessment results may overestimate site exposures, human health risks, and potential migration within the vadose zone.

3.3.2 Background Concentrations of Benzene in Air

In order to provide the reader with a frame of reference relative to the predicted concentrations of benzene in indoor air, it is important to attempt to characterize the background concentration of benzene in ambient air. Benzene is a common component of air in urban environments and results from automobile exhaust and industrial emissions. For the period from 1996 through 1999, the reported background concentration of benzene in air within the Los Angeles basin was approximately 6.2 micrograms per cubic meter ($\mu g/m^3$) (Waxman, 1999). This value is approximately 6,000 times higher than indoor air concentration predicted in the vapor diffusion analysis. Consequently, diffusion of benzene into indoor air does not contribute significantly to the background concentration.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Potential carcinogenic and non-carcinogenic risks were quantitatively evaluated under a post-development scenario. Potential site uses evaluated in this analysis included both future residential and commercial development alternatives, including the construction of an underground parking area. The only potentially complete exposure pathway associated with the future use of the property involves inhalation of volatile organic compounds in indoor air. Chemicals that were included in the quantitative evaluation of risk were BTEX and MTBE diffusing from residual impacted soil and/or soil vapor.

The results of this analysis indicate that potential upper-bound exposures to hydrocarbons in indoor air under future residential and commercial land uses are below the range of acceptable risks typically established by the EPA, CalEPA, and other regulatory entities. Based on this information, no additional mitigation or control measures are required to protect future site occupants from exposure to hydrocarbons in indoor air.

5.0 REFERENCES

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TABLE

Table 1

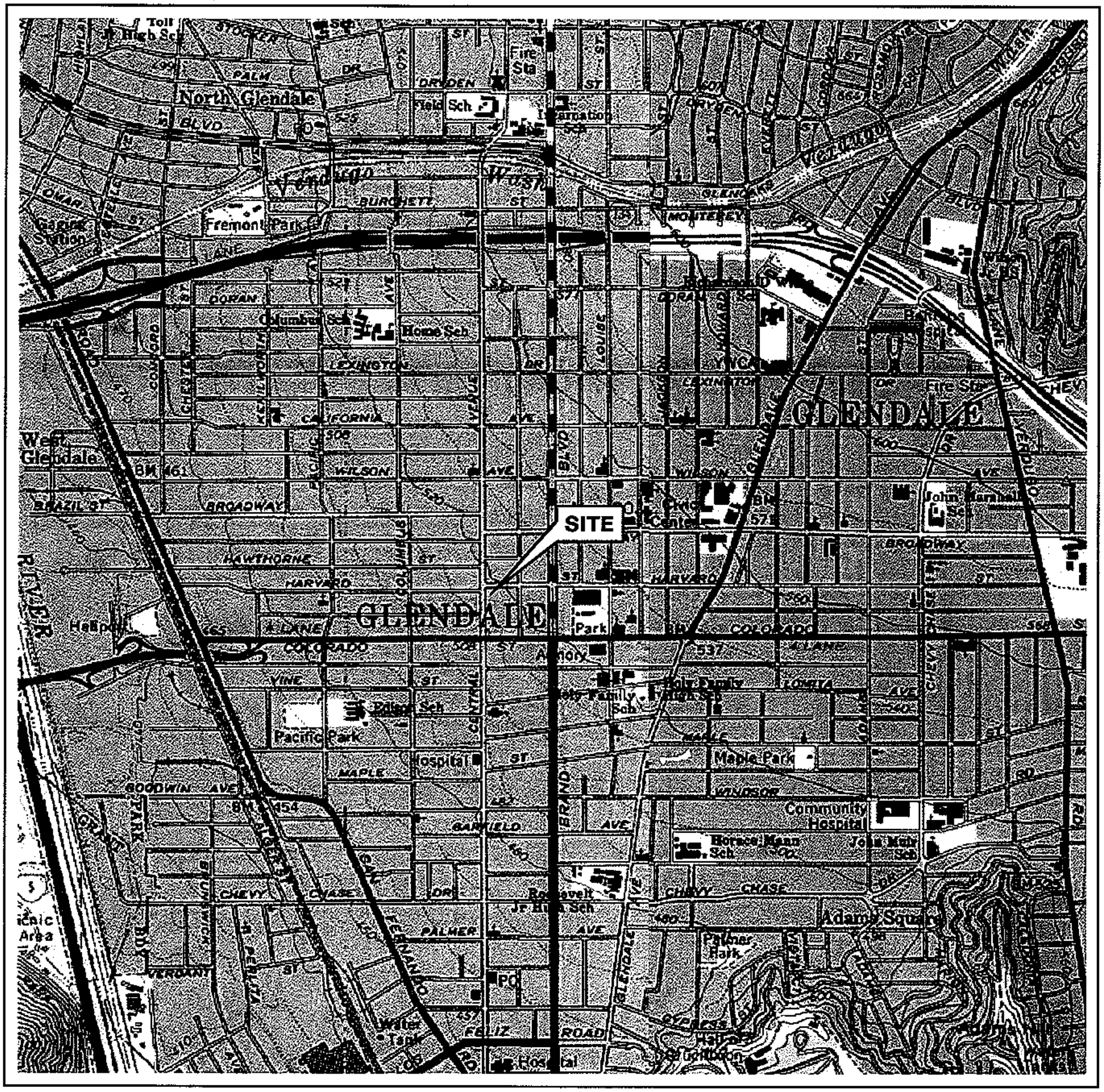
RESULTS OF LABORATORY ANALYSIS OF SOIL VAPOR SAMPLES
Former 76 Station 0353

Well Number	Sample Date	Depth (fbg)	TPH-G (ppm)	Benzene (ppm)	Toluene (ppm)	Ethyl-benzene (ppm)	Total Xylenes (ppm)	MTBE (ppm)	ETBE (ppm)	DIPE (ppm)	TAME (ppm)	TBA (ppm)
			EPA TO-3	EPA Method TO-14A								
SG-1@15.0	8/22/2005	**15.0**	**2.0**	ND<0.0020	**0.010**	**0.0054**	**0.029**	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	**0.013**
SG-1@20.0	8/22/2005	**20.0**	**2.3**	**0.0020**	**0.0090**	**0.0041**	**0.021**	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	**0.015**
SG-1@25.0	8/22/2005	**25.0**	**1.9**	ND<0.0020	**0.011**	**0.0038**	**0.018**	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	**0.022**
SG-2@15.0	8/22/2005	**15.0**	**1.7**	ND<0.0020	**0.020**	**0.0091**	**0.047**	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.010
SG-2@20.0	8/22/2005	**20.0**	**2.0**	ND<0.0020	**0.018**	**0.013**	**0.069**	**0.0064**	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.010
SG-2@25.0	8/22/2005	**25.0**	**2.2**	ND<0.0020	**0.019**	**0.012**	**0.063**	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.010
SG-3@15.0	8/22/2005	**15.0**	**2.1**	ND<0.0020	**0.014**	**0.0077**	**0.039**	**0.0020**	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.010
SG-4@15.0	8/22/2005	**15.0**	**1.9**	**0.0021**	**0.021**	**0.0059**	**0.024**	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.0020	ND<0.010

NOTES:

TPH-G = total petroleum hydrocarbons as gasoline
MTBE = methyl tertiary butyl ether
DIPE = di-isopropyl ether
TAME = tertiary-amyl methyl ether
ETBE = ethyl tertiary-butyl ether
TBA = tertiary-butyl alcohol
ND = not detected at the detection limit indicated
fbg = feet below grade
mg/kg = milligrams per kilogram

FIGURES



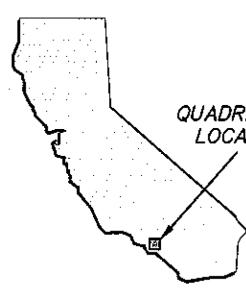
0 1/4 1/2 3/4 1 MILE

SCALE 1:24,000

N

SOURCE:

United States Geological Survey
7.5 Minute Topographic Map:
Pasadena Quadrangle



TRC

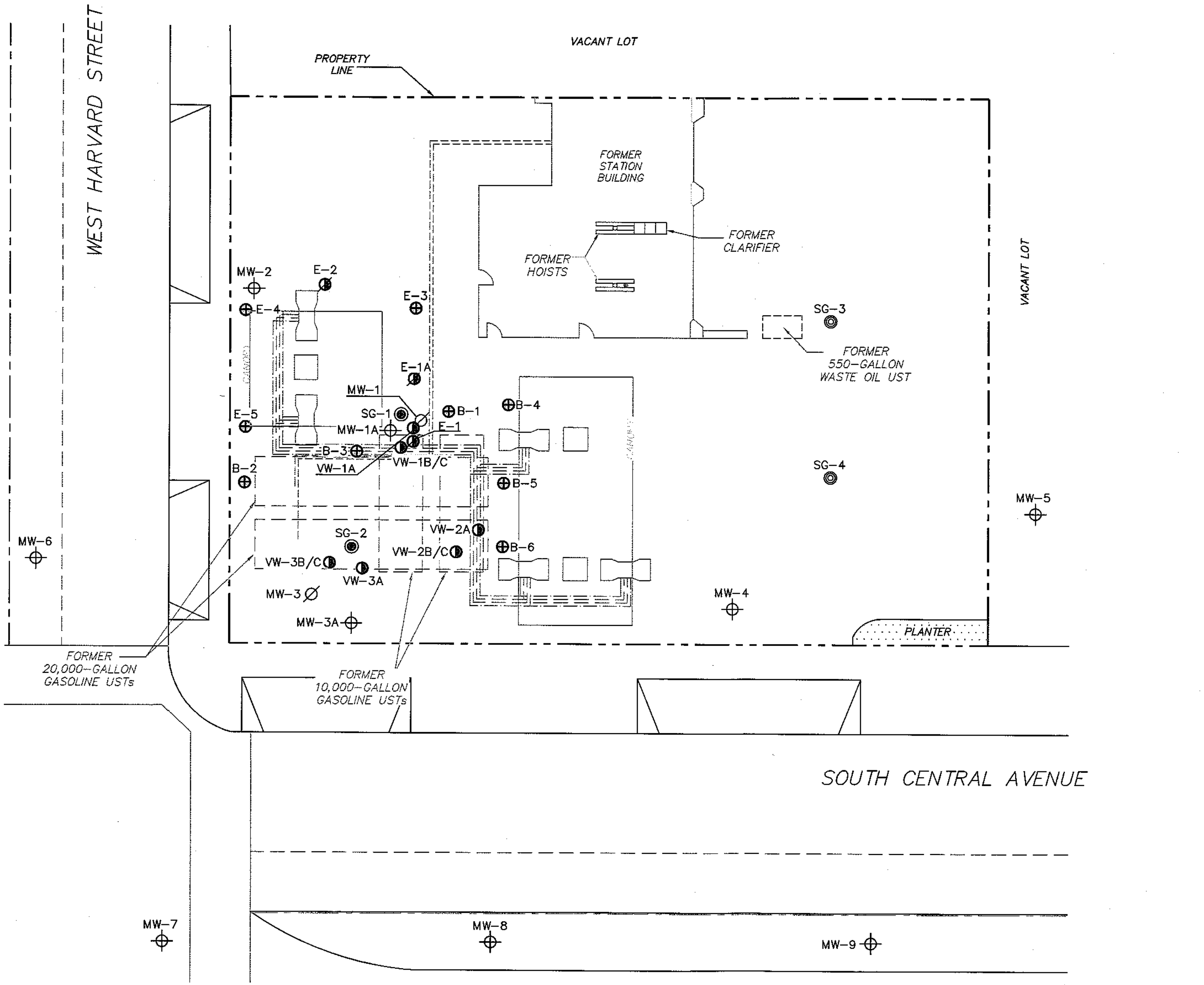
VICINITY MAP

Former 76 Station 0353
200 South Central Avenue
Glendale, California

FIGURE 1

PS = 1:1

L:\ VICINITY MAPS\0353VM.dwg Jan 17, 2006 – 10:54am lwinters



LEGEND

- SG-4 Soil Gas Probe
- SG-2 Soil Gas Probe Cluster
- VW-3B/C Vapor Well
- MW-3 Abandoned Monitoring Well
- E-2 Abandoned Vapor Well
- MW-9 Monitoring Well
- B-6 Boring
- Dispenser Island
- Canopy Support

NOTES:

Modified from a map provided by EP Associates, dated 01/05. UST = underground storage tank.

SCALE (FEET)
0 20

SITE PLAN

Former 76 Station 0353
200 South Central Avenue
Glendale, California

TRC

FIGURE 2

PS=1:1

L:\Graphics\ProjectsByNumber\20-xxxx\20-0800_\20-0948_76#0353\0353 SCALE_1-20.dwg Jan 17, 2006 - 11:17am lwinters

APPENDIX A

VAPOR DIFFUSION AND RISK CALCULATIONS

Table A-1
Summary of Toxicity Criteria
Former 76 Station 0353
200 South Central Avenue, Glendale, California

Chemical	Carcinogen Classification	CSF Inh. $(mg/kg\text{-}day)^{-1}$	CSF Inh. Source	Inh. Rfd (mg/kg-day)	Inh. RfD Source
VOCs					
Benzene	A	1.00E-01	CalEPA	8.60E-03	IRIS
Toluene	NC	NA	NA	1.10E-01	IRIS
Ethylbenzene	NC	NA	NA	2.90E-01	IRIS
Xylenes	NC	NA	NA	2.90E-02	IRIS
Methyl t-Butyl Ether (MTBE)	C*	9.10E-04	CalEPA	8.60E-01	IRIS

Notes:

CSF = Cancer Slope Factor

RfD = Reference Dose

CalEPA = California Environmental Protection Agency

IRIS = Integrated Risk Information System

A = Known Human Carcinogen

NA = Not Available

NC = Not classified as to carcinogenicity

* = Chemical not classified by IRIS as a carcinogen, but evaluated for potential carcinogenic effects based on toxicity values cited by CalEPA (CalEPA, 2004)

Table A-2
Summary of Exposure Parameters
Former 76 Station 0353
200 South Central Avenue, Glendale, California

		Future Onsite Worker	**Future Residential Occupant**
Exposure Parameter	**Units**	**Inhalation of Vapors**	**Inhalation of Vapors**
Inhalation Rate	m^3/hour	1.25	0.83
Incidental Soil Ingestion Rate	mg/day		
Exposed Skin Surface Area	cm^2		
Soil-Skin Adherence Factor	mg/cm^2-day		
Exposure Interval	hour/day	10	24
Exposure Frequency	days/year	250	350
Exposure Duration	years	25	30
Body Weight	kg	70	70
Averaging Time (carcinogens)	days	25,550	25,550
Averaging Time (non-carcinogens)	days	9,125	10,950

References

Common Exposure Parameters
- Exposure parameters common to all exposure scenarios include:
- Body weight of 70 kg for adult exposures (EPA, 1997)
- Averaging time for carcinogens equal 365 days/year x 70 years (EPA, 1997)
- Averaging time for noncarcinogens equals exposure duration (30 years) x 365 days per year
- Exposure frequency of 250 days per year for occupational exposure scenario represents a maximum plausible exposure of five (5) days per week, fifty weeks per year
- Exposure frequency of 350 days per year for occupational exposure scenario represents a maximum plausible exposure of seven (7) days per week, fifty weeks per year
- Exposure duration of 30 years represents a Reasonable Maximum Exposure (RME) value

Inhalation of Vapors in Outdoor Air (from soil gas)
- Inhalation rate of 1.25 m^3/hour based on light activity pattern (EPA, 1997)
- Inhalation rate of 0.83 m^3/hour based on residential activity pattern (EPA, 1997)
- Exposure interval of 10 hours per day represents a maximum plausible exposure

Table A-3
Summary of Soil to Indoor Air Volatilization Factors
Former 76 Station 0353
200 South Central Avenue, Glendale, California

EQUATION

$$VF_{is} = C_{sg} / C_{bldg}$$

SYMBOLS AND DESCRIPTIONS	UNITS	VALUES
C_{sg} = Initial soil gas concentration[a]	ug/m^3	see below
C_{bldg} = Estimated infinite source building concentration[b]	ug/m^3	see below
VF_{is} = Indoor air volatilization factor (from soil gas)	unitless	see below

Chemical	C_{sg}	C_{bldg}	Vf_{is}
Benzene	6.82E+00	1.04E-03	6.56E+03
Toluene	8.04E+01	1.23E-02	6.54E+03
Ethylbenzene	5.74E+01	8.77E-03	6.55E+03
Xylenes	3.05E+02	4.65E-02	6.56E+03
Methyl t-Butyl Ether (MTBE)	2.35E+01	3.59E-03	6.55E+03

Notes:

[a] = Highest measured concentration of chemical in soil gas (August 22, 2005) was used with the Johnson & Ettinger (J & E) Spreadsheet, dated February 2003, in order to calculate COPC-specific volatilization factors

[b] = Indoor air volatilization factor derived from J & E Spreadsheet

Table A-4
Carcinogenic Risks from Inhalation of Vapors in Indoor Air from Soil
Future Onsite Worker
Former 76 Station 0353
200 South Central Avenue, Glendale, California

Chemical	Concentration in Soil Gas (mg/m^3)	Indoor Air Volatilization Factor (unitless)	Estimated Indoor Air Concentration (mg/m^3)	LADD (mg/kg-day)	Inhalation CSF $(mg/kg\text{-}day)^{-1}$	Risk
VOCs						
Benzene	6.82E-03	6.56E+03	1.04E-06	4.54E-08	1.00E-01	**4.5E-09**
Methyl t-Butyl Ether (MTBE)	2.35E-02	6.55E+03	3.59E-06	1.57E-07	9.10E-04	**1.4E-10**
					PATHWAY TOTAL	**4.7E-09**

Notes:

$C_a = (C_{sg}/VF_i)$

C_a = Estimated concentration of chemical in air (mg/m^3)
C_{sg} = Measured concentration of chemical in soil gas (mg/m^3) (maximum concentration detected from August 22, 2005 sampling)
VF_i = Indoor air volatilization factor (unitless)

LADD = Lifetime Average Daily Dose = C_a x IR x ET x EF x ED x 1/AT x 1/BW
C_a = Chemical concentration in air (mg/m^3)
IR = Inhalation rate (m^3/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time, carcinogens (days)
BW = Body weight (kg)

CSF = Cancer Slope Factor

Table A-5
Carcinogenic Risks from Inhalation of Vapors in Indoor Air from Soil
Future Residential Occupant
Former 76 Station 0353
200 South Central Avenue, Glendale, California

Chemical	Concentration in Soil Gas (mg/m^3)	Indoor Air Volatilization Factor (unitless)	Estimated Indoor Air Concentration (mg/m^3)	LADD (mg/kg-day)	Inhalation CSF $(mg/kg\text{-}day)^{-1}$	Risk
VOCs						
Benzene	6.82E-03	6.56E+03	1.04E-06	1.22E-07	1.00E-01	**1.2E-08**
Methyl t-Butyl Ether (MTBE)	2.35E-02	6.55E+03	3.59E-06	4.20E-07	9.10E-04	**3.8E-10**
					PATHWAY TOTAL	**1.3E-08**

Notes:

$C_a = (C_{sg}/VF_i)$

C_a = Estimated concentration of chemical in air (mg/m^3)

C_{sg} = Concentration of chemical in soil gas (mg/m^3) (maximum concentration detected from August 22, 2005 sampling)

VF_i = Indoor air volatilization factor (unitless)

LADD = Lifetime Average Daily Dose = C_a x IR x ET x EF x ED x 1/AT x 1/BW

C_a = Chemical concentration in air (mg/m^3)
IR = Inhalation rate (m^3/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time, carcinogens (days)
BW = Body weight (kg)

CSF = Cancer Slope Factor

Table A-6
Non-Carcinogenic Risks from Inhalation of Vapors in Indoor Air from Soil
Future Onsite Worker
Former 76 Station 0353
200 South Central Avenue, Glendale, California

Chemical	Concentration in Soil Gas (mg/m^3)	Indoor Air Volatilization Factor (unitless)	Estimated Indoor Air Concentration (mg/m^3)	Average Daily Dose (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Index
VOCs						
Benzene	6.82E-03	6.56E+03	1.04E-06	1.27E-07	8.60E-03	**0.000015**
Toluene	8.04E-02	6.54E+03	1.23E-05	1.50E-06	1.10E-01	**0.000014**
Ethylbenzene	5.74E-02	6.55E+03	8.77E-06	1.07E-06	2.90E-01	**0.0000037**
Xylenes	3.05E-01	6.56E+03	4.65E-05	5.69E-06	2.90E-02	**0.00020**
Methyl t-Butyl Ether (MTBE)	2.35E-02	6.55E+03	3.59E-06	4.39E-07	8.60E-01	**0.00000051**
					PATHWAY TOTAL	**0.00023**

Notes:

$C_a = (C_{sg}/VF_i)$

C_a = Estimated concentration of chemical in air (mg/m^3)

C_{sg} = Concentration of chemical in soil gas (mg/m^3) (maximum concentration detected from August 22, 2005 sampling)

VF_i = Indoor air volatilization factor (unitless)

Average Daily Dose = C_a x IR x ET x EF x ED x 1/AT x 1/BW

C_a = Chemical concentration in air (mg/m^3)

IR = Inhalation rate (m^3/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time, non-carcinogen (days)

BW = Body weight (kg)

RfD = Reference Dose

Table A-7
Non-Carcinogenic Risks from Inhalation of Vapors in Indoor Air from Soil
Future Residential Occupant
Former 76 Station 0353
200 South Central Avenue, Glendale, California

Chemical	Concentration in Soil Gas (mg/m^3)	Indoor Air Volatilization Factor (unitless)	Estimated Indoor Air Concentration (mg/m^3)	Average Daily Dose (mg/kg-day)	Inhalation RfD (mg/kg-day)	Hazard Index
VOCs						
Benzene	6.82E-03	6.56E+03	1.04E-06	2.84E-07	8.60E-03	**0.000033**
Toluene	8.04E-02	6.54E+03	1.23E-05	3.36E-06	1.10E-01	**0.000031**
Ethylbenzene	5.74E-02	6.55E+03	8.77E-06	2.39E-06	2.90E-01	**0.0000083**
Xylenes	3.05E-01	6.56E+03	4.65E-05	5.69E-06	2.90E-02	**0.00020**
Methyl t-Butyl Ether (MTBE)	2.35E-02	6.55E+03	3.59E-06	9.80E-07	8.60E-01	**0.0000011**
					PATHWAY TOTAL	**0.0003**

Notes:

$C_a = (C_{sg}/VF_i)$

C_a = Estimated concentration of chemical in air (mg/m^3)

C_{sg} = Concentration of chemical in soil gas (mg/m^3) (maximum concentration detected from August 22, 2005 sampling)

VF_i = Indoor air volatilization factor (unitless)

Average Daily Dose = C_a x IR x ET x EF x ED x 1/AT x 1/BW

C_a = Chemical concentration in air (mg/m^3)

IR = Inhalation rate (m^3/hour)

ET = Exposure time (hours/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

AT = Averaging time, non-carcinogen (days)

BW = Body weight (kg)

RfD = Reference Dose

Table A-8
Summary of Carcinogenic and Noncarcinogenic Risk Estimates for All Pathways
Future Onsite Worker and Residential Occupant Exposures
Former 76 Station 0353
200 South Central Avenue, Glendale, California

Exposure Pathway and Chemical	Future Onsite Worker		Future Residential Occupant	
	Risk	Hazard Index	Risk	Hazard Index
Inhalation of Vapors - Soil				
Benzene	**4.5E-09**	**0.000015**	**1.2E-08**	**0.000033**
Toluene	**NA**	**0.000014**	**NA**	**0.000031**
Ethylbenzene	**NA**	**0.0000037**	**NA**	**0.0000083**
Xylenes	**NA**	**0.00020**	**NA**	**0.00020**
Methyl t-Butyl Ether (MTBE)	**1.4E-10**	**0.00000051**	**3.8E-10**	**0.0000011**
Pathway Total	**5E-09**	**0.0002**	**1E-08**	**0.0003**

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
71432			2.10E-03	Benzene

MORE

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER (Totals must add up to value of Ls (cell F24)) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
457	457	20	457	0	0	S		

MORE

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
9	40	1000	1000	244	0.1	6	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	1	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	4,000	6.82E+00	4.07E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.83E+06	1.41E-04	457	8,019	4.39E-03	1.83E-01	1.78E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	1

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
457	6.82E+00	0.10	6.22E+01	1.42E-02	4.00E+02	5.70E+42	1.53E-04	1.04E-03	7.8E-06	3.0E-02

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
108883			2.10E-02	Toluene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
457	457	20	457	0	0	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
9	40	1000	1000	244	0.1	6	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm³/cm³)	Stratum B soil air-filled porosity, θ_a^B (cm³/cm³)	Stratum C soil air-filled porosity, θ_a^C (cm³/cm³)	Stratum A effective total fluid saturation, S_{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k_i (cm²)	Stratum A soil relative air permeability, k_{rg} (cm²)	Stratum A soil effective vapor permeability, k_v (cm²)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. (µg/m³)	Bldg. ventilation rate, $Q_{building}$ (cm³/s)
9.46E+08	1	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	4,000	8.04E+01	4.07E+05

Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm²/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm²/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)	Diffusion path length, L_d (cm)
2.83E+06	1.41E-04	457	9,045	5.10E-03	2.12E-01	1.78E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	1

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m³)	Unit risk factor, URF (µg/m³)⁻¹	Reference conc., RfC (mg/m³)
457	8.04E+01	0.10	6.22E+01	1.41E-02	4.00E+02	1.77E+43	1.53E-04	1.23E-02	NA	4.0E-01

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
100414			1.30E-02	Ethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
457	457	20	457	0	0	S		

Totals must add up to value of Ls (cell F24)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
9	40	1000	1000	244	0.1	6	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	1	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	4,000	5.74E+01	4.07E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.83E+06	1.41E-04	457	10,040	5.89E-03	2.45E-01	1.78E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	1

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
457	5.74E+01	0.10	6.22E+01	1.21E-02	4.00E+02	1.47E+50	1.53E-04	8.77E-03	NA	1.0E+00

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
95476			6.90E-02	o-Xylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
457	457	20	457	0	0	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
9	40	1000	1000	244	0.1	6	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	1	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	4,000	3.05E+02	4.07E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.83E+06	1.41E-04	457	10,291	3.85E-03	1.60E-01	1.78E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	1

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
457	3.05E+02	0.10	6.22E+01	1.41E-02	4.00E+02	1.77E+43	1.53E-04	4.65E-02	NA	1.0E-01

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1634044			6.40E-03	MTBE

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
457	457	20	457	0	0	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
9	40	1000	1000	244	0.1	6	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	1	0.321	0.321	0.321	0.003	1.01E-07	0.998	1.01E-07	4,000	2.35E+01	4.07E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.83E+06	1.41E-04	457	7,165	5.07E-04	2.11E-02	1.78E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	1

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
457	2.35E+01	0.10	6.22E+01	1.66E-02	4.00E+02	5.53E+36	1.53E-04	3.59E-03	NA	3.0E+00

END